

**Enhanced Water Quality Monitoring and Modeling Program for the
A.R.M. Loxahatchee National Wildlife Refuge
Quarterly Update Report – April 2016**

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Overview

This update is a summary of activities since the previous status report of March 2016 on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. This quarterly report serves as the final quarterly report for this project as the project has been defunded. A project overview, and other detailed information about the program can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program (Brandt et al. 2004) focuses on providing information for use in ecological management of the Refuge (e.g., USFWS 2007a, b; USFWS 2009; USFWS 2010a, b; USFWS 2012a; USFWS 2012b; USFWS 2013; USFWS 2014; USFWS 2015).

The Refuge's monitoring component of this program also addresses one of the Consent Decree Principals recommendations (17 December 2003):

B. Enhancing Monitoring of the Refuge

Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.

Information Availability

Through collaboration with USGS, information from the Refuge's Enhanced Water Quality Monitoring and Modeling Program has been made available on the USGS' SOFIA web site at: http://sofia.usgs.gov/lox_monitor_model/.

Final data for monthly samples through May 2006 are publicly posted on DBHYDRO by the SFWMD at http://my.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_page. Data for June 2006-April 2016 are posted on the Technical Oversight Committee's web site at <http://www.sfwmd.gov/toc/>. This report includes information from samples collected through April 2016.

Water Quality Data Analyses Update

Primary efforts for this quarter involved exploring mechanisms to continue translating information from the program to aid in Refuge management decisions, and working on the program's Annual Report.

Monitoring Update (April 2016)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 33 in April 2016 (**Table 1**).

Total phosphorus data available to date for July 2015 through April 2016 are presented in **Table 1**. A map of stations where samples were collected in April 2016 is presented in **Figure 2**.

Conductivity sonde deployment information for July 2015 through April 2016 is presented in **Table 2**.

Next Steps

The next steps for this program include additional efforts on the Annual Report.

References

- Brandt, L.A., Harwell, M., Waldon, M. (2004) Work Plan: Water Quality Monitoring and Modeling for the A.R.M. Loxahatchee National Wildlife Refuge: 2004-2006. Prepared for the A.R.M. Loxahatchee National Wildlife Refuge. April, 2004. 33 pp.
- USFWS. (2007a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Monitoring and Modeling Program – 2nd Annual Report – February 2007. LOXA06-008, U.S. Fish and Wildlife Service, Boynton Beach, FL. 183 pp.
- USFWS. (2007b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 3rd Annual Report – October 2007. LOXA07-005, U.S. Fish and Wildlife Service, Boynton Beach, FL. 116 pp.
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- USFWS. (2012b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 8th Annual Report – October 2012. LOXA12-004, U.S. Fish and Wildlife Service, Boynton Beach, FL. 68 pp.
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- USFWS (2014) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Program – 10th Annual Report for calendar year 2013 – June 2014. LOXA14-002, U.S. Fish and Wildlife Service, Boynton Beach, FL. 71 pp.
- USFWS (2015) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Program – 11th Annual Report for calendar year 2014 – June 2015. LOXA15-002, U.S. Fish and Wildlife Service, Boynton Beach, FL. 81 pp.

Table 1. Total phosphorus data (ppb) available for July 2015 – April 2016 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loxahatchee National Wildlife Refuge. Graphical representation of station locations are shown in Figure 1.

a) Marsh stations

Marsh Station	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16
LOXA101	-	-	46	17	19	11	11	8	11	13
LOXA102	-	-	32	14	10	10	8	8	10	15
LOXA103	-	-	28	15	10	13	9	10	10	12
LOXA105	-	-	44	23	22	13	13	9	13	12
LOXA106	-	-	24	14	13	9	10	6	9	10
LOXA107	-	-	13	12	11	10	10	6	11	-
LOXA108	-	-	12	9	8	5	6	6	9	10
LOXA109	-	12	13	13	9	8	11	7	9	10
LOXA110	-	4	13	6	10	5	7	6	6	9
LOXA111	-	-	19	8	10	9	12	7	10	7
LOXA112	-	-	14	13	10	6	9	6	6	8
LOXA113	-	-	14	11	9	8	6	8	9	9
LOXA114	-	-	13	10	9	11	7	7	8	9
LOXA117	-	-	25	20	13	10	14	4	12	14
LOXA118	-	-	15	16	10	11	10	4	10	9
LOXA119	-	15	11	12	7	5	7	5	7	9
LOXA120	-	11	10	8	10	8	6	4	8	9
LOXA122	-	-	18	22	17	12	13	6	12	15
LOXA124	-	-	50	19	24	33	20	14	20	15
LOXA126	-	9	13	12	9	9	8	4	6	8
LOXA127	-	15	10	11	8	9	6	3	7	-
LOXA128	-	-	11	8	7	8	4	5	9	-
LOXA130	-	14	23	13	8	12	11	8	8	10
LOXA131	-	8	13	11	7	8	11	7	8	12
LOXA133	-	36	29	22	14	18	14	10	9	14
LOXA134	-	17	16	14	7	12	13	9	8	10
LOXA136	-	-	32	20	14	12	13	13	10	16
LOXA137	-	-	19	14	10	9	12	7	9	10
LOXA138	-	-	17	11	6	6	13	7	7	10
LOXA139	-	-	12	12	11	8	9	9	6	8
LOXA140	-	-	21	14	9	8	11	11	9	9
LOXA141	-	17	13	16	5	9	7	20	18	-
MAX	0	36	50	23	24	33	20	20	20	16
MIN	0	4	10	6	5	5	4	3	6	7

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 1 cont.

b) Canal stations

Canal Station	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16
LOXA104	25	20	24	27	20	18	19	19	19	23
LOXA115	15	18	27	28	16	20	19	50	20	25
LOXA129	17	51	17	13	19	14	20	36	21	18
LOXA132	16	42	19	15	17	15	18	63	19	20
LOXA135	18	25	17	18	14	16	18	68	23	18
MAX	25	51	27	28	20	20	20	68	23	25
MIN	15	18	17	13	14	14	18	19	19	18

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 2. July 2015 – April 2016 conductivity sonde deployment information, separated by transect, for the A.R.M. Loxahatchee National Wildlife Refuge. X = data collected from sonde deployment during that month. Graphical representation of station locations are shown in Figure 1.

	2015						2016			
Site ID	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
LOXA104	X	X		X	X		X		X	X
LOXA105	X		X	X		X		X		X
LOXA106	X		X	X		X		X		X
LOXA107	X		X	X		X		X		X
LOXA108	X		X	X		X		X		X
LOXA115	X			X	X		X		X	
LOXA116		X	X	X		X		X		X
LOXA117	X		X	X		X		X		X
LOXA118	X		X	X		X		X		X
LOXA119	X		X	X		X		X		X
LOXA120	X		X	X		X		X		X
LOXA129	X	X		X	X		X		X	X
LOXA130	X		X	X		X		X		X
LOXA131	X		X	X		X		X		X
LOXA132		X	X	X			X		X	X
LOXA133		X		X		X		X		X
LOXA135	X	X		X	X		X		X	X
LOXA136		X		X		X		X		X
LOXA137	X		X	X		X		X		X
LOXA138	X		X	X		X		X		X
LOXA139	X		X	X		X		X		X
LOXA142		X			X		X			X
LOXA143	X			X			X		X	
LOXA144	X			X			X		X	
LOXA145	X			X			X		X	
LOXA146	X			X			X		X	
LOXA147	X		X			X		X		X
LOXA148		X		X		X			X	
LOXA149		X		X		X			X	
LOXA150		X		X		X			X	
LOXA151	X	X		X	X		X			X
LOXA152	X	X		X	X		X		X	X
LOXA153	X	X		X	X		X			X
I-8C	X	X			X		X		X	
LOX04	X		X	X		X		X		X
LOX15		X		X		X			X	

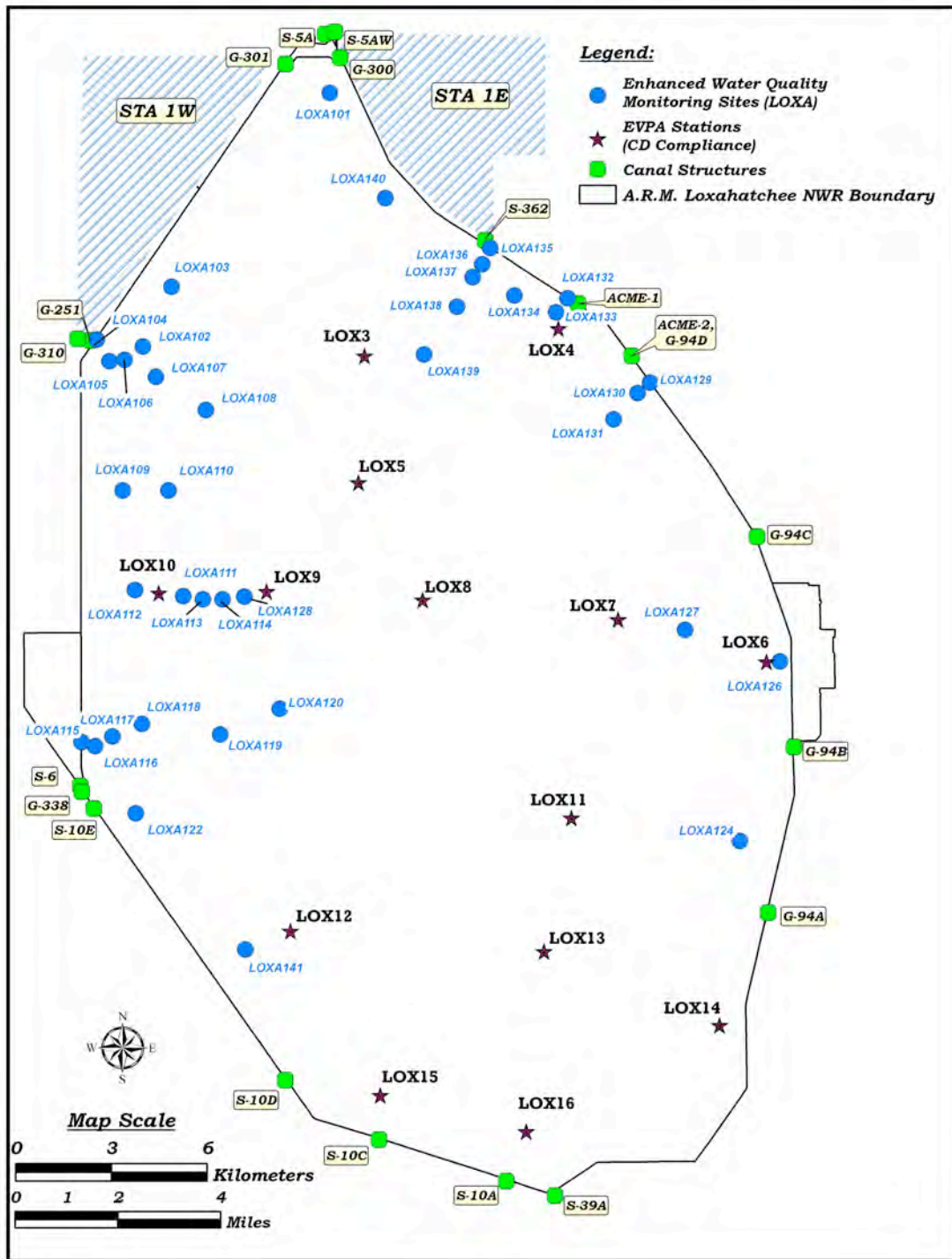


Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

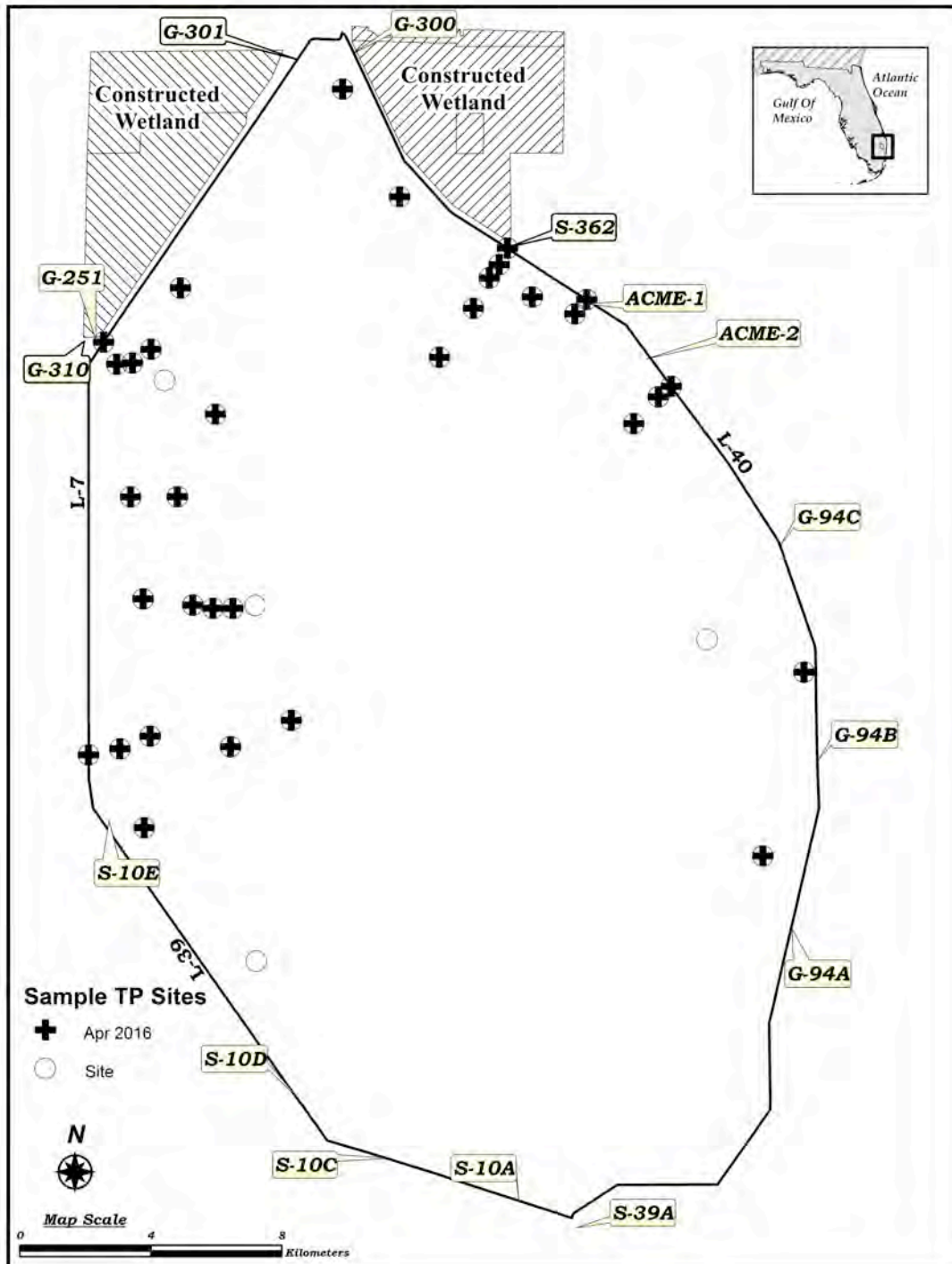


Figure 2. April 2016 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.